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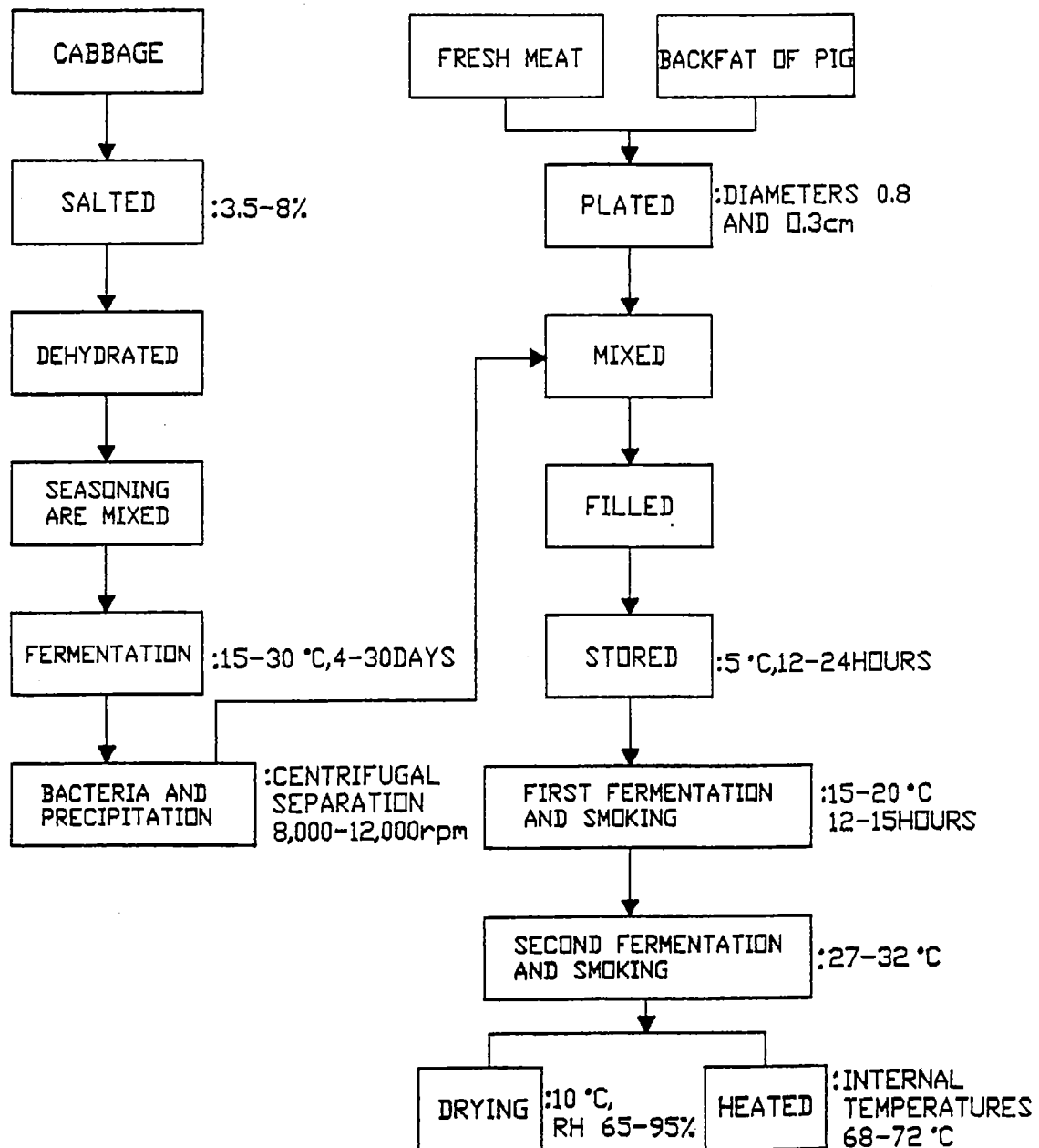
(54) **Method for producing kimchi-fermented sausage**

(57) Kimchi-fermented sausages are produced by fermenting kimchi, containing for example 3.5 to 8.0% salt, to produce acidification, separating kimchi solids containing kimchi-fermenting bacteria for example by centrifugation at 8,000 to 12,000 rpm, and mixing the kimchi solids with meat to form a mixture containing for example 3 to 20% of kimchi by weight of the meat, then fermenting the mixture and if desired drying the fermented mixture.

Kimchee is a fermented vegetable food.

GB 2 243 528 A

FIG.1



METHOD FOR PRODUCING KIMCHI-FERMENTED SAUSAGE

The present invention relates to a method for producing kimchi-fermented sausages, which are produced by mixing kimchi containing 1.3% acidity with meat at the rate of 3-20%, and then fermenting the first and second fermenting process of the KIMCHI-meat mixture firstly at 15°C-20°C and secondly at 27°C-32°C, respectively.

The kimchi is a traditional Korean fermented vegetable food made by mixing the salted vegetables such as cabbages or radishes with various seasonings and then naturally maturing. In the fermenting and maturing of the kimchi, a lot of number of micro-organisms act on the fermentation and maturity of the kimchi.

Among them, fungi are acid-vulnerable aerobic micro-organisms that thrive at temperatures 20-30°C, and yeasts are aerobic micro-organisms that thrive at temperatures 27°C-28°C, give unique fragrance and taste of matured kimchi and also form thin layers on the kimchi in the post-maturity period of the kimchi.

Accordingly, primary micro-organisms involved in the fermentation of the kimchi are bacteria derived from raw materials such as cabbage,

the seasonings and other materials during preparation of the kimchi.

In the maturing process of the kimchi, aerobic bacteria, such as achromobacter, flavobacterium, bacillus and pseudomonas groups, which are not associated with lactic acid fermentation grow at the beginning of fermentation and then acid-enduring anaerobic bacteria, such as *lactobacillus planetarium* and *leuconostoc mesenteroides* grow proceeding the lactic acid fermentation. After the maturity period, yeasts, such as sacchromyces, torulopsis, candida, hansenula, debaryomyces, pichia and rhodotorula, grow by use of lactic acid.

As the fermentation goes on, the number of aerobic bacteria are reduced and organic acids like the lactic acid are gradually generated and accordingly pH goes down and acid-enduring bacteria start to grow. As the acid-enduring bacteria grow up producing lactic acid, malic acid, acetic acid and oxalic acid, the pH of the kimchi is dramatically dropped, content of reduced sugar is decreased, acidity is increased, and therefore the fermenting and maturing process is proceeded. If the kimchi is fermented and matured in low temperature, it is *leuconostoc*

*mesenteroides* that is a bacterium which continues to multiply in numbers from the beginning until the maturity period of the kimchi where it reaches a maximum in numbers. While the *leuconostoc mesenteroides* is not much as able other acid-producing bacteria in producing acid, it is a bacteria that plays important role in giving unique tastes and flavors up to a degree of being capable of maturing

the kimchi by itself. This bacteria grows more actively when it is given a lower degree of salt concentration. This bacteria also grow more rapidly at cooler temperatures than a normal temperature, thriving up to 32% of the entire population of various bacteria. The *leuconostoc*

*mesenteroides* is a representative lactic acid bacteria that give the kimchi not only sour taste but also pleasant taste by producing organic acid group such as the lactic acid, ethanol and carbon dioxide gas. The environment of the kimchi changes eventually from aerobic to anaerobic by taste products. Therefore, most of aerobic bacteria that do not contribute to fermentation of the kimchi is slowed down in growth or die away. When the kimchi is matured at room temperature, *lactobacillus planetarium* grows more actively than *leuconostoc mesenteroides* and gets to 32% of the entire bacteria population. The *lactobacillus planetarium* is a representative lactic-fermenting lactic bacteria that increases acidity by lactic acid producing.

Fermented sausages originate from the Middle Ages and are known to be produced by filling salted fresh meat into intestines and drying. Italian salami of today is considered to be the origin.

Traditionally, most of fermented sausages including the salami and fermented hams known as uncooked ham or raw ham were produced mainly in Mediterranean coastal areas. They had its slightly different brand name, shape and processing methods in each area.

Recently, it was discovered that natural fermentation is caused by bac

-teria so that fermented sausages and hams could be artificially produced by applying lactic acid bacteria as starter culture. As Cesari tried applying yeast in 1919, Kurk used micrococci in 1921, Drake used bacilli and spirilli in 1928, Jesen and Paddock used lactobacilli in 1940, the technology of producing the fermented sausages and hams was gradually developed. The technology has continually been improved as summer sausage was developed in U.S.A. in 1957 by developing freezing-dried *pediococcus cerevisiae*. Racovita developed a method of spraying penicillium on the surface of dried sausage in 1968, Eilberg and Liepe developed a method of bringing streptomycetes into a mixed lactic bacteria(streptococci and lactobacilli) in 1977, and Bartholomew and Blumer developed a method of applying *pediococcus cerevisiae* to country ham in 1977.

As in the foregoing, micro-organisms, such as bacteria, fungi and yeast, can be used in meat fermentation but most popularly applied microorganisms used as starter micro-organisms are salt-enduring lactic bacteria, such as micrococci, streptococci, *pediococci* and lactobacilli.

The invention provides a first aspect a method for producing a kimchi-fermented sausage, which method comprises:

5 (a) fermenting kimchi to produce acidification thereof and separating kimchi solids containing kimchi-fermenting bacteria; and

(b) mixing the kimchi solids with meat such that the kimchi solids are 3 to 20% by weight of meat, fermenting the mixture of kimchi and meat by performing a first  
10 fermentation at 15 to 20°C and fermentation at 27 to 32°C, and then drying the fermented mixture.

In a second aspect, the invention provides a mould for producing kimchi-fermented sausage, which method comprises:-

15 (a) fermenting kimchi containing from 3.5 to 8% by weight of salt at from 15 to 30°C to produce acidification and separating kimchi solids containing kimchi-fermenting bacteria; and

(b) mixing the kimchi solids with meat and fermenting  
20 the kimchi-meat mixture.

The invention includes a method for producing a kimchi-fermented sausage comprising mixing fermented kimchi solids containing fermentation bacteria with meat and fermenting the kimchi-meat mixture.

25 In the illustrative embodiments hereinafter described the kimchi fermentation period is controlled by adjusting temperature until lactic bacteria, which are most adaptive to fermenting meat, are most active in the kimchi, and substances of the kimchi and the bacteria therein are  
30 obtained by using a centrifugal method and then the kimchi substances already having flavour and taste are applied to the meat, thus the meat is fermented by re-fermentation of the kimchi thereafter. Therefore, natural lactic acid bacteria with matured kimchi can use instead of starter  
35 culture and avoid a danger of bacteriophage.

In addition, temperature control is provided in a way that can improve fermentation process of the meat in which the micro-organisms of the kimchi acts as fermentation agent.

5        And in general processes, such as method of slicing and mixing the kimchi and the raw material meat, filling the mixture of kimchi and the meat into a casing, and then salting, fermenting, smoking and drying operations, prior technology has been employed.

10       In order to use the kimchi as a starter culture effectively, each process is specifically conditioned so that fermenting and maturing can be better performed.

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## BRIEF DESCRIPTION OF THE ATTACHED DRAWING

For a better understanding of the invention and to show how the same may be carried into effect reference will now be made, by way of example, to the accompanied diagrammatic drawing, in which :

FIG 1 is a process diagram illustrating processes of producing kimchi-fermented sausage.

## DETAILED DESCRIPTION OF THE INVENTION

As shown in FIG 1, the producing of the kimchi-fermented sausage comprises following four processes.

First process, which is Kimchi Preparation process, wherein :

cabbages are salted in salty water of 7-15% concentration, and dehydrated until the salt concentration reaches 3.5-8% ;  
seasonings, such as pepper powder, raw garlic, ginger, and sugar and so on are mixed with the salted cabbages ;  
the salted and seasonings-mixed cabbages are matured at temperatures of 15-30° C for 4-30 days so that pediococci and lactobacilli can grow well ; and  
when the lactic bacteria grow until total acidity reaches 1.3%, fermentation is stopped and now, the cabbage has become kimchi that contains a lot of micro-organism, so the kimchi is put into centrifugal oper

-ation at 7,000-15,000rpm for fifteen minutes, and only the precipita-  
-tion of the kimchi containing bacteria, which is to be used as starte-  
-r micro-organism, is obtained.

Second process, which is Mixing and Filling process, wherein :

fresh meat stored at -3 to -1° C and backfat of pig are plated two  
times with diameters of 0.8 cm and 0.3cm, respectively the ground meat  
is mixed with the kimchi material, which is 3-20% of the ground meat  
quantity, for 5-10 minutes ;

and

this mixture of the kimchi and the ground meat are filled into a flexi-  
-ble fiber-type casing, stored at 5° C for 12-24 hours in a dark room,  
so that stabilization of micro-organisms of the kimchi and salting can  
be achieved.

Third process, which is Fermentation and Smoking process, wherein:

after the second process, a first fermentation and smoking are per-  
-formed at 15-20° C for 12-15 hours at the same time, and then a second  
fermentation and smoking are performed at 27-32° C is performed until  
the mixture reaches to pH5.2-4.8.

Fourth process, which is Drying process. wherein:

after the third process, the mixture is heated up until internal  
temperatures of the mixture reache 68-72° C; or the mixture is put into  
a container, which provides constant temperature and humidity, and the  
mixture is dried up by applying gradual decrease from RH95% down to RH

65% at 10° C and the wind velocity of 10m per minute for 3-12 weeks.

Now, some exemplaries of the present invention are presented hereinafter.

#### EXAMPLE 1

As shown in TABLE 1, after cabbage kimchi of 3.5% salt concentration is prepared, the kimchi is matured at 15° C for 20-30 days until the kimchi gets an acidity level of 1.3%. This kimchi is sliced by going through plates with diameters of 0.8cm and 0.3cm, respectively. And then the kimchi is put into a centrifugal operation at 8000-12000 rpm for 15 minutes and only kimchi material is obtained by removing supernatant, and the precipitation is ready to be used as starter micro-organisms (First process).

TABLE 1 Composition of Kimchi Mixture

Items	Quantity(g)
cabbage	100
powdered pepper	3.0
green onion	2.0
garlic	0.7
ginger	0.7
sugar	0.7
salt	3.5-7.0

Fresh meat and fat as raw materials of fermented-sausage are ones that have been stored at  $-3$  to  $-1^{\circ}\text{C}$  and plated with diameters of 0.8cm and 0.3cm respectively. The first mixing is performed by mixing the ground meat with seasonings as listed in TABLE 2 into a mixer, The second mixing is performed by mixing the ground fat into mixture of the fresh meat and seasonings, and finally the third mixing is performed by mixing 108-288g of the kimchi material that is prepared in first process and has starter micro-organisms.

The final mixture is put into fibrous casing that has a diameter of 1.0 - 5.0cm and then is stored at  $5^{\circ}\text{C}$  in a dark room for 18 hours for

equ-ibilization(Second Process).

After equibilization is completed, fermentation and smoking are performed at the same time.

In an early period of the fermentation, the sausage is kept at 15-20° C for 12 hours to promote growth of *leuconostoc mesenteroides* and micrococci groups which generate aromatic products. And then the temperature is raised up to 27° C at which lactic acid is generated by dramatic increase of lactic bacteria, and the fermentation is stopped when pH of the meat is dropped down to 5.0. For smoking, it is recommendable to use sawdust of wood that is aromatic and has no resin(Third Process).

After the fermentation and smoking have been completed, the sausage is put into a humidity chamber, and the sausage is dried up by applying gradual decrease of relative humidity from 95% down to 65% at 10 C and in the wind velocity of 10m per minute for 3-12 weeks(Fourth Process).

TABLE 2 Composition of Kimchi- Fermented Sausage

Items	Weight(g)
MEAT	
meat(pork)	1350
meat(beef)	1350
backfat	900
SALTING AGENTS	
Sodium Nitrate( $\text{NaNO}_3$ )	0.58
Sodium Nitrite( $\text{NaNO}_2$ )	0.29
Sodium Ascorbate( $\text{C}_6\text{H}_7\text{O}_6\text{Na}$ )	3.2
Salt	60.0
SEASONINGS	
Garlic	36
black pepper	7.2
mustard	1.26
powdered pepper	36
ginger	18
grape sugar	32.4
matured kimchi	108-720

## EXAMPLE 2

The kimchi is prepared with 5% salt concentration as shown in Table 1, fermented and matured at 25-30° C for 4-10 days where total acidity becomes 1.3%, and then ground twice as shown in EXAMPLE 1 (First Process).

Fresh meat and fat ground as in the EXAMPLE 1 are mixed as in EXAMPLE 1, and 360-720g of the ground kimchi is mixed. this mixture is put in to a fiber-type casing, which has diameter of 3-7cm and kept therein for 6-12 hours at 10° C for performing salting operation and stabilization of starter micro-organisms (Second Process).

The mixture is fermented and smoked at the same time, first for 12 hours at 15 C and then at temperatures of 28-32° C until pH of the mixture is dropped down to 4.8 at which level the fermentation and smoking operation is stopped (Third Process).

The sausage which the fermentation is completed is heated up to a point where temperature of inner center of the sausage reaches 70° C (Fourth Process).

TABLE 3      Characteristics of Kimchi-Fermented Sausage

Characteristics	EXAMPLE 1	EXAMPLE 2
	(dry-type)	(semi-dry-type)
pH	5.0	4.8
moisture(%)	28-43	52
moisture/protein	1.7-2.3 : 1	3.2 : 1
free amino nitrogen(mg%)	47-40	32
total number of bacteria(cells/g)	$6.2 \times 10^7 - 2.5 \times 10^6$	$4.6 \times 10^3$
number of lactic bacteria(cells/g)	$8.9 \times 10^6 - 1.4 \times 10^6$	$2.3 \times 10^3$
taste and flavor	mild taste	strongly sour taste

Products produced according to foregoing methods can be classified as dry-type kimchi-fermented sausage(EXAMPLE 1) and Semi-dry-type kimchi-fermented sausage(EXAMPLE 2) as shown in TABLE 3. The EXAMPLE 1 is dry-type sausage which contains low moisture and shows relatively high in pH due to long drying period, so that it is hard and has mild taste. On the other hand, the EXAMPLE 2 is Semi-dry-type sausage which shows relatively low in pH, and contains high moisture, so that it has strong sour taste.



CLAIMS

1. A method for producing a kimchi-fermented sausage, which method comprises:

(a) fermenting kimchi to produce acidification thereof and separating kimchi solids containing kimchi-fermenting bacteria; and

(b) mixing the kimchi solids with meat such that the kimchi solids are 3 to 20% by weight of meat, fermenting the mixture of kimchi and meat by performing a first fermentation at 15 to 20°C and a second fermentation at 27 to 32°C, and then drying the fermented mixture.

2. A method as claimed in Claim 1, wherein the fermenting kimchi in step (a) contains from 3.5 to 8% by weight of salt.

3. A method as claimed in Claim 1 or Claim 2, wherein step (a) is conducted at a temperature of from 15 to 30°C.

4. A method as claimed in any one of Claims 1 to 3, wherein said fermentation step (a) is continued until the total acid content of the ferment reaches 1.3% by weight.

5. A method as claimed in any one of Claims 1 to 4, wherein said kimchi solids are separated by centrifugation.

6. A method as claimed in Claim 5, wherein said centrifugation is conducted at 8,000 to 12,000 rpm.

7. A method for producing kimchi-fermented sausage, which method comprises:-

(a) fermenting kimchi containing from 3.5 to 8% by weight of salt at from 15 to 30°C to produce acidification and separating kimchi solids containing kimchi-fermenting bacteria; and

(b) mixing the kimchi solids with meat and fermenting the kimchi-meat mixture.

8. A method as claimed in any preceding claim, including the step of forming the kimchi meat mixture into a sausage.

9. A method as claimed in Claim 8, wherein said mixture is formed into a sausage prior to drying said mixture.

10. A method as claimed in any preceding claim, wherein:  
the fermented mixture in the form of a sausage is put  
into a humidity chamber, and dried by applying a gradual  
decrease of relative humidity from RH95% to RH65% at about  
10°C and at a wind velocity of about 10m per minute for 3  
to 12 weeks, so as to produce a dry-type sausage.

11. A method for producing kimchi-fermented sausage as  
claimed in Claim 1, wherein:

the fermented mixture in the form of a sausage is  
heated up to a point where inside temperature of the  
sausage reaches 68 to 72°C, so as to produce a semi-dry  
type sausage.

12. A method as claimed in any preceding claim, wherein:

after the kimchi solids are mixed with the meat, the  
mixture is put into a casing, is stored in a dark room for  
6 to 12 hours, and is then fermented two times.

13. A method for producing a kimchi-fermented sausage  
substantially as hereinbefore described in Example 1 or  
Example 2.

14. A method for producing a kimchi-fermented sausage  
comprising mixing fermented kimchi solids containing  
fermentation bacteria with meat and fermenting the kimchi-  
meat mixture.

15. A method for producing a kimchi-fermented sausage,  
method comprising the processes of

(a) fermenting kimchi, wherein 3.5 to 8.0% salt is  
contained, at 15 to 30°C until total acid content reaches  
1.3% and then obtaining kimchi precipitation containing  
kimchi-fermenting bacteria by putting the kimchi into a  
centrifugal operation at 8,000 to 12,000 rpm;  
and

(b) mixing the kimchi precipitation with meat being 3  
to 20% of meat, fermenting a mixture of kimchi and meat,  
performing a first fermentation at 15 to 20°C and  
fermentation at 27 to 32°C, and then drying the fermented  
mixture.